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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: [A] (A = ADD, C = CHANGE, D = DELETE) — PP

2. DOCUMENT CODE: 3

3. COUNTRY ENTITY: DS/AGR RDA-2
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5. PROJECT NUMBER (7 digits): [931-0562.11]

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7. PROJECT TITLE (Maximum 40 characters): [Improvement of Tropical Beans/Cowpeas]

8. ESTIMATED FY OF PROJECT COMPLETION: FY [8|0]

9. ESTIMATED DATE OF OBLIGATION: For 10 month extensic
A. INITIAL FY [8|0] B. QUARTER [1] (Enter 1, 2, 3, or 4)
C. FINAL FY [8|0]

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =) For 10 month extension

A. FUNDING SOURCE	FIRST FY 80			LIFE OF PROJECT		
	B. FX	C. L/C	D. TOTAL	E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	291	-	291	291	-	291
(GRANT)	(291)	(-)	(291)	(291)	(-)	(291)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY						
OTHER DONOR(S)						
TOTALS	291	-	291	291	-	291

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. Thru 9/30/79		H. 1st FY 80		K. 3Rd FY 81	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN
(1) FN	111 I	973	-	2,422	-	291	-	0	-
(2)									
(3)									
(4)									
TOTALS				2,422	-	291	-	0	-

A. APPROPRIATION	N. 3RD FY 82		O. 4TH FY 83		LIFE OF PROJECT	
	O. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN
(1) FN	0	-	0	-	2,713	-
(2)						
(3)						
(4)						
TOTALS	0	-	0	-	2,713	-

12. IN-DEPTH EVALUATION SCHEDULED: N/A (MM / YY)

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[1] 1 = NO, 2 = YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Dean F. Peterson

TITLE: Director, Office of Agriculture, DSB

DATE SIGNED: MM DD YY

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (3-78)

BEST AVAILABLE

PROPOSAL TO THE AGENCY FOR INTERNATIONAL DEVELOPMENT

FOR

EXTENSION OF THE BEAN/COWPEA PROJECT, IMPROVEMENT OF———

TROPICAL PRODUCTION OF BEANS AND COWPEAS THROUGH DISEASE AND INSECT CONTROL

(CONTRACT AID/TA-C-1296)

UNIVERSITY OF PUERTO RICO

MAYAGUEZ CAMPUS

4 MAY 1979

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PROJECT STATEMENT

A. Project Summary

1. Statistical

Project Title:	Improvement of tropical production of beans and cowpeas through disease and insect control.
New or Extension:	Extension
Contractor:	University of Puerto Rico Mayaguez, Puerto Rico
Project Director:	Dr. Julio H. López-Rosa Phytopathologist
Duration:	April 16, 1979 - September 30, 1980
Total Estimated Cost:	
Funding:	
Prior Years:	$2,181,755
Project Extension Funding 4/16/79-9/30/80	$634,683
FY 1979 Proposed	$186,999
FY 1980 Proposed	$447,684
Project Manager:	Dr. John M Yohe

2. Narrative

The common bean (*Phaseolus vulgaris* L.) and the cowpea (*Vigna unguiculata* (L.) Walt. subsp. *unguiculata* Verd.) are major grain legumes that provide important sources of protein for the human diet in many of the lesser developed countries (LDCs) of the tropics. In these areas, legumes are consumed in conjunction with cereals to obtain a better amino acid balance. Though often of considerable importance in certain areas of the temperate zones, these grain legumes are generally consumed as part of a variety of foods. In all production areas, one of the major constraints is disease susceptibility.

The basic goal of this project is to improve, by various means, production of beans and cowpeas in the tropics. Efforts to achieve this goal have consisted of (1) identification of major diseases and insect pests, (2) screening for resistant germ plasm, (3) development of methods for breeding for multiple disease resistance, and (4) combination of these resistances with high yields and other commercially desirable traits. In cases where little or no resistance has been found, the project has evaluated chemical control measures as an alternative and has continued the search for resistances in similar and related legume species.

Continuation of the project will permit: concentration of large RSPs (recurrent selection populations) into smaller, more manageable populations and the selection of promising bean lines for release; transmission to beans of disease resistances from other Phaseolus species, e.g., resistance to bacterial blights, which is not presently found in the common bean; development (completion) of chemical control measures; intensification of efforts to disseminate results and materials (advanced selections and other useful germ plasm) in Central American and Caribbean countries; and complementation of CIAT's efforts in training personnel from national edible legume programs by specific training to be offered to project's cooperators from Central America and the Caribbean.

3. Background

The research project on improvement of tropical production of beans and cowpeas was extended from May 1976 to September 1978. Based on project accomplishments, which were noted "with commendation", a review team recommended an additional two year extension in June 1978. However, the extension proposal was considered unacceptable at the October 31-

November 1, 1978, and January 29, 1979 RAC meetings. This new proposal is responsive to RAC's comments and the proposed plan of work will permit termination of the chemical control aspects of the research, publication of results, and concentration of the project's resources into the breeding effort. Continuation and strengthening of breeding research, and intensification of outreach activities under the proposed extension will lead to optimum utilization of the funds invested in the project.

B. Research Purpose and Objectives

1. Purpose

The purpose of the proposed extension is to continue the improvement of tropical production of beans and cowpeas via the use of multiple disease and insect resistance and control measures. The development of multiple resistant cultivars of commercial potential and management technologies related to their use will benefit farmers and consumers of the developing countries by providing increased production of these major food crops.

2. Objectives of the Proposed Extension

1. Locate additional sources or types of resistance by screening new materials.

2. Develope RSPs for high frequency of major and minor genes for multiple resistances.

3. Develop and release breeding lines for high levels of multiple disease resistance.

4. Select, test and release advanced lines for combined multiple disease resistance, yield and commercial potentials.

5. Develop RSPs in closely related Phaseolus species (P. coccineus, others) for important disease resistances not presently found in the common bean, specifically, bacterial blights (Xanthomonas spp.), angular leaf spot, necrotic strain of BCMV, BGMV and soybean rust.

6. Confirm the levels of insect resistance and their economic significance for the project's advanced lines.

7. Confirm the effectiveness of selected fungicides for controlling soil-borne pathogens.

8. Evaluate microorganisms in the field for controlling foliar and soil-borne pathogens.

9. Strengthen the network of Cooperators in LDCs and of interested principal bean scientists in the US who are willing to receive and use disease resistant germ plasm, and participate in trials of improved disease resistant lines in the principal bean production areas.

10. Provide specific on-site research training in PR to cooperators from LDCs in efforts to improve scientist-to-scientist working relationships, increase uniformity of procedures, and update research skills.

11. Hold a symposium on identification, distribution, and prospects for control of diseases and insects of beans and cowpeas in Tropical America. The published papers from this symposium will meet the obligation for a disease-pest control monograph.

C. Significance and Rationale for the Research

1. The Development Problem

A growing world population requires adequate nutrition for normal growth and development as well as for optimum physical performance. It is generally recognized that protein is one of the most important components of human nutritional requirements. Traditional sources of high quality protein are meat, dairy products, fowl, and fish. These are relatively high cost foods and are consumed mostly in the developed countries, or where adequate pasturelands and low population densities exist, usually in temperate zones. In the tropics, marginal land areas, or areas of high population density, cereals and pulses together are frequently a cheap and satisfactory protein source.

As populations grow and land use intensifies, grain legumes on the better lands are usually displaced by the cereals or other crops. This creates an ever smaller supply of pulses, especially in relation to the cereals (which have often increased in yields) with which they should be consumed in particular proportions. In addition to this gradual relegation of pulse crops to more marginal lands, the presence of diseases and insects often cause serious losses, and result in production fluctuations on a national scale.

A recent CIAT publication ("Evolution of bean production in Latin America during the last decade", by J. H. Sanders and C. Alvarez P., 1978) traces some of the major trends in the countries of this region. The authors show that the Latin American countries account for over 1/3 of the total world bean production. Yields, however, are only about 2/5 of those obtained in the US and Canada. Although bean production has increased in many countries, output for the area rose an average of only 0.25% per year, while population grew 2.8%. This has resulted in lower consumption per capita, which can have grieveous consequences considering that beans are the main protein source for a majority of the people.

There are three principal solutions to this dilemma: (1) increase land usage, (2) importation, or (3) increase and stabilize yields. The first alternative occurs to some extent through agrarian reform and population pressure, but has not been very effective in increasing grain legume production since other crops are generally more economically productive, and appropriate new lands are limited in area. Nevertheless, most national increases in production are probably due to this source (0.8% increase). The importation of beans runs into problems of balance

of payments and the fact is that local varieties are often preferred to the exclusion of many high yielding available commercial types. Transportation and distribution problems also make market penetration of imports difficult in any but the large population centers.

The third solution, on which this project has focused efforts, is by far the most appropriate, but also the most difficult and slowest to extend into many of the production areas. Difficult, because in spite of adequate research knowledge and some very good yield and disease resistance sources, the task of combining these into the myriad bean seed types required for the multitude of production areas, necessitates bean scientists, research institutions and adequate budgets within each country and production area. These are all in short supply.

The main deterrent to adequate national research budgets and institutions is found in the nature of the crop itself. In temperate zones, bean culture has been mechanized and yields are relatively high (1,372 k/ha for the US and Canada), so this legume competes fairly well with other crops. This requires relatively flat land and fairly high inputs. In the tropics, where there are many disease and insect problems, good level lands in areas of appropriate climate are limited and inputs are much more costly. Yields have fluctuated greatly and beans have not been able to compete with other tropical crops such as bananas, sugarcane, cassava, cotton and the cereals (rice, corn, sorghum). Consequently, in a majority of the LDCs of Latin America, the crop is cultivated in areas, often in association with corn (or some other crop) on steep hillsides unsuitable to modern agricultural methods. Bean production from this type of cultivation has been estimated to be as

high as 80-90% of the total. It is not likely that this cultivation pattern will change because of the large numbers of rural farmers involved, and the economics of tropical production.

In studies carried out at CIAT (Annual Report, 1977) on the evaluation of technology at the farm level in Honduras, in areas where the small bean farmer was involved, it was concluded that a modern "technological package" including use of fertilizers and insecticides would be economically unadvisable due to the high costs involved and the instability of rainfall. In similar studies of small farmer systems in Colombia, CIAT found that if the price ratio of corn to beans is around 1:4, planting of beans alone or in association with corn are economically comparable, but if the price relation is less than 1:4 then intercropping becomes preferable to beans alone. In addition, they conclude that "small farmers, who evade high risks, will prefer the association even when beans alone yield more economically. The majority of the farmers who have enough hand labor.....select the associated cropping system to reduce production costs and to obtain a greater stability of income".

The solution of bean production problems through the use of high input technological packages (including the use of fertilizers) does not seem to be the most practical (on good lands beans do not compete well with other crops and the small farmers who are primarily concerned with bean production do not wish to risk the costs involved). Perhaps the most productive method of providing inmediate and long term assistance is by improving yield stability. This can best be accomplished through the protection from loss provided by increased disease and insect resistances. This has been the main guiding philosophy for the project.

D. Plans to Develop Linkages and to Facilitate the Utilization of Research

Since it is practically impossible to provide the exact bean types each production area requires, we have built up relationships with major bean breeders and phytopathologists in Latin America to receive breeding materials and released lines as produced by the project. Over the last 4 years we have also distributed uniform trials of advanced lines to selected cooperators, usually plant breeders, in each country where a major interest in this type of cooperation has been shown. We have also travelled to the countries to assist in planning cooperative research and have attended the annual regional research meetings.

We have met a great deal of difficulty in our attempts to maintain these ties and in obtaining useful feedback. Several reasons may account for this. The 1975 AID publication Roster of Scientists for Major Food Crops of the Developing World shows very few scientists in each country assigned to bean pathology or breeding. The turn-over rate is extremely high as can be appreciated by a comparison with those still on the job in-country at the end of 1978.

	1975	1978[1/]
Colombia	4	0
Costa Rica	5	3
Ecuador	0	0
El Salvador	1	0

1/ From "List of bean scientists (P. vulgaris L.) in Latin America and the Caribbean", Compiled by Oswaldo Voysest, CIAT, 1978.

	1975	1978[1/]
Guatemala	3	1
Honduras	1	0
Nicaragua	0	0
Panama	0	0
Venezuela	1	1

These scientists are more numerous in the larger, more advanced countries and in countries with International Research Centers and are scarce in the others. This can be appreciated from one of the most recent listings of bean scientists as follows:

Bean Scientists in Latin American Countries[1/]

Large Countries	General	Bean Improvement
Brazil	88	18
Mexico	28	5
W/International Centers		
Colombia	49 (32 CIAT)	12 (4 CIAT)
Guatemala	13 (9 ICTA)	5 (4 ICTA)
Costa Rica	13 (1 CIAT: none at CATIE)	1
Others		
Nicaragua	9	2
Honduras	12	2
El Salvador	11	1
Venezuela	7	2

1/ From "List of bean scientists (P. vulgaris L.) in Latin America and the Caribbean", Compiled by Oswaldo Voysest, CIAT, 1978.

In addition, there have been unforeseeable difficulties in attending the yearly meetings, which have been held with our cooperators at the Central American Cooperative Food Crop Improvement Program (PCCMCA) annual meeting, due to natural disasters (earthquake in 1976 caused cancellation in Guatemala - meeting was rescheduled in Costa Rica), and political unrest (the situation in Nicaragua caused cancellation in 1978 - meeting was rescheduled in El Salvador). These types of difficulty are to be expected with some frequency in Latin America. In addition USDA personnel, who have assumed a major portion of the outreach responsibilities, have had foreign travel limited by normal USDA restrictions. Thus UPR scientists have met with cooperators on occasions when PCCMCA meeting sites have been changed on short notice.

These yearly contacts with national bean scientists have been the principal mechanism by which the project contacts interested scientists and stimulates interest in receiving breeding lines and continued cooperation. Without personal contacts it is extremely difficult to maintain communication with the national personnel and their programs. The proposed addition of an outreach agronomist (UPR) with field travel capabilities, will strengthen this aspect of making the project's results available to the national programs.

Not only are scientists scarce in the national programs often devoting only a portion of their time to bean work, but facilities are also limited. This can be appreciated from data provided by the publication "Agricultural Experiment Stations of Latin America", BID, Washington, 1971, 367 pp, in which detailed information is given for 206 experiment stations of which 80% are maintained by the national governments. Many

of the rest are connected to the universities which in general are completely disconnected from the national programs. The majority were established recently and are in various stages of development and often without permanent personnel. The professional staff is comprised mainly by university graduates (20-30% with MS). Individual scientists handle several crops and various disciplines. Only 10% of the stations have libraries, and most of thes. ack scientific journals.

The national bean programs are operating under the most constraining circumstances. This is caused by their extremely limited resources. Most lack proper research facilities, personnel and budget for their own research programs and are unable to meet the demands imposed by regional (PCCMCA), international (CIAT), and others (FAO, IICA), and other projects such as ours. Personnel and budgets are consigned and do not respond to the needs of the research to be accomplished. The project has tried to fit in with the interests of the national programs to provide assistance and breeding materials not obtained elsewhere.

International Programs

Centro Internacional de Agricultura Tropical (CIAT) -Colombia

CIAT has, among the international agricultural centers, world responsibility for beans. Our project has established and maintains close ties with the Center's Bean Program. Mutually beneficial collaboration has been achieved through the exchange of materials and information, and participation of staff from each program in workshops and project's reviews.

CIAT has assumed the major responsibility for general training of research staff through short courses and in-service training. Comple

mentation of the CIAT's training effort can be accomplished by the project by training scientists from the English speaking Caribbean, a geographic area which is not presently covered by CIAT, in aspects related to bean and cowpea culture.

International Institute of Tropical Agriculture (IITA) - Nigeria

IITA has world responsibility for cowpea. Close cooperation exists between the project and IITA, with reciprocal visits by scientists and exchange of cowpea germ plasm, which maintain each locale up-to-date on recent work and advanced materials produced by each program. Diseases and strains of pathogens have been somewhat different between the two continents which makes work at the two institutions complementary. Lines from IITA have been generally low in root rot resistance, so that the project's resistances of this type should be very useful to them. Availability of male sterility and good bush plant types from IITA will benefit breeding in our project.

Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA)

The PCCMCA organization has played a major part in bringing together the Central American scientists from the different disciplines specializing with several major crop plants (rice, corn, sorghum, and beans and, lately, vegetables and fruits). These yearly gatherings have functioned somewhat like the regional Academy of Science meetings in the US. Scientists have met and discussed common problems. They present reports of recent research and also formulate plans for cooperation -- usually uniform variety trials. We have used these meetings

as an opportunity to introduce our program, to meet with our cooperators, to discuss work accomplished and problems encountered and to make plans for the year's continued cooperation.

Food and Agriculture Organization (FAO) and Instituto Interamericano de Ciencias Agrícolas (IICA)

Both FAO and IICA have had regional or local specialists assisting with research, training, or in advisory capacities in many of the Latin American countries for both short and long periods of time. The assistance has often been in advisory capacity in chemical or integrated pest control, economic or sociologic problems and extension. Research in pathology and crop breeding has been done by graduate student training at CATIE (IICA) at Turrialba, especially in the mid-1970's. The Project's interests and cooperative work in Central America are highly compatible with those of these two institutions.

National Programs

ICTA - Guatemala. The Institute of Agricultural Science and Technology (ICTA) is the Guatemalan organization responsible for agricultural research and development. Strong ties and assistance are maintained with the international centers of CIAT and CIMMYT, and with AID. Our present cooperation is through Dr. Porfirio Masaya, Bean Program Coordinator and Ing. Silvio Hugo Orozco of the Bean Program.

SRN-EAP - Honduras. The bean improvement work in Honduras is carried out under the Ministry of Natural Resources (SRN) which maintains a germ plasm, pathology, and breeding component in conjunction with the Panamerican School of Agriculture (EAP). Ing. Leonardo Ordoñez (SRN)

and Professor Víctor Muñoz (EAP) are doing this work and have received breding lines and advanced materials for trials from the Project. Prof. Muñoz attended the Project's Cooperators Workshop in Mayaguez in 1977. In addition, SRN maintains two Agronomists, Ing. Otto Luis Tercero and Ing. Héctor Fernández, who are in charge of cultural practices and yield trials at the Danlí Experiment Substation. These programs are receiving our breeding materials and advanced lines each year.

SRN-BID - Honduras. A Pilot Project of Corn and Beans for extension of technology and improved varieties with the small farmer is underway in one of the principal grain production regions of Danlí (southeastern Honduras). This is a cooperative extension project of the Ministry of Natural Resources (SRN) and the Interamerican Development Bank (BID) in close cooperation with International Agricultural Research Centers (CIMMYT and CIAT). We have been in close contact with this work through Ing. José Montenegro, Director of the Program, who is also a bean pathologist and a graduate from the University of Puerto Rico at Mayaguez. They have received our advanced lines and are testing them under conditions of the small farmer.

INTA - Nicaragua. Our cooperator has been Ing. Silvio A. Chávez of the Grain Legume Project of the Nicaraguan Institute of Agricultural Technology (INTA). However, since the outbreak of coffee rust, most of the funds and professional's time have been occupied in the large scale eradication measures being developed, and because of the recent political unrest in this country, conditions have been difficult, at best, for the normal bean research program.

Costa Rica. The principal bean research in this country is being accomplished at the University of Costa Rica under the Department of Plant Pathology. Our principal cooperators have been Dr. Rodrigo Gámez, virologist, and Ing. Edgar Vargas, rust specialist. Ing. Vargas attend the Project's 1977 Cooperators Workshop. The National Production Board (CNP) has assisted in providing land and field personnel to plant out cooperative trials through Ing. José Francisco Ramírez of this institution.

We have maintained contact with the basic genetic work in beans, principally in mutagenesis by chemicals and nuclear isotopes, which has been done by Dr. Moh, at the Nuclear Center at Turrialba, and have received germ plasm for testing from this program which has shown no disease resistances. Other research at CATIE has involved the economics of bean production and land use and multiple cropping systems. We received publications and exchange information, but most of our contacts are via the University.

El Salvador. Bean production has been greatly reduced and replaced by the principal export crops (cotton, coffee, sugarcane) and by the cereal crops (corn, rice, sorghum) in all of the major production areas of El Salvador. In addition, the high incidence of BGYMV, a disease agent to which no resistance has been found in beans, has prevented commercial production in most lowland areas. Research in bean pathology and agronomic practices has therefore undergone a number of changes in El Salvador.

New facilities of the government research center (CENTA) are being built and staffed at San Andrés. AID, through contracts with US univer-

sities, especially the University of Florida, have been instrumental in this development. Our cooperator at this center has been agronomist Ing. Carlos Mario García, Department of Plant Technology, who attended the Project's 1977 Cooperators Workshop.

Dominican Republic. Our cooperator in this country was Ing. Freddy Saladín-García, Director of the Department of Agricultural Investigations of CNIEGA, who has received the advanced lines for local trials, and has visited our research facilities in Mayaguez. Ing. Saladín also attended the Project's 1977 Cooperators Workshop. Presently, our cooperator in the Dominican Republic is Dr. César Paniagua, a recent graduate from Michigan State University and a student of Dr. M. W. Adams.

US Institutions

Perhaps because of the intense research interests of US scientists, their well developed research programs, good facilities and adequate budgets, close cooperation has developed with several bean programs at Universities and USDA facilites. The cooperation has generally developed around common interests or in areas in which the project can utilize certain services the US institutions could provide. Some of these research objectives are: strain and race identification of pathogens and resistances, adaptability of tropical germ plasm use, and protein content.

USDA - Prosser, Washington. Working cooperation has been established with two USDA scientists as follows: Dr. D. Burke has been interested in the project's lines for root rot resistance and yield for the pink bean type. Dr. M. Silbernagel is interested in broad-based germ plasm for yellow mosaic virus resistance and in the strains of

BCMV of the necrotic type. The project has supplied germ plasm sources for these purposes and expects to continue to exchange information and materials for advancement to obtain useful resistances for these serious bean diseases.

USDA - Beltsville. Dr. J. Meiners has contributed with evaluation of project lines for resistances to rust, and in breeding for improved pintos for US temperate areas. This work will be continued and should result in broader race resistance for US breeders working with rust and should shorten the time required to obtain satisfactory pinto beans for the Caribbean islands and other countries interested in pinto bean types.

Wisconsin. Dr. F. Bliss at the University of Wisconsin, Madison, has been engaged, principally through support from AID, in research on the storage proteins of beans. With exchange of materials he is using some Project lines to broaden his genetic base for improved populations for yield and protein content. Through monitoring the protein content of our lines, several have been identified which seem to offer special promise of combining high yield and protein. This cooperative protein work will be enlarged through new research funds granted by the USDA-Tropical Agricultural Development (Sec. 406) to the Mayaguez Institute of Tropical Agriculture (MITA). This work contemplates more complete screening of the tropical disease resistant germ plasm for protein content, total yield and protein yield production/area and contents of anti-nutritional factors, such as tannins. This work will be done principally at MITA in cooperation with the University of Wisconsin and the University of Puerto Rico and will provide a protein nutritional compo-

Florida. Dr. M. Bassett at the University of Florida, Gainesville, has had major research interests in the use of P. coccineus for the transfer of useful genes for winter hardiness and the terminal stigma of this species to the common bean. The project has exchanged germ plasm for these purposes and now is engaged in cooperation to transfer disease resistance from this species (P. coccineus) through several different possible genetic routes. The research in most advanced stage of development of these routes is through use of standard backcrosses techniques using highly fertile lines. The second is by the use of P. coccineus wild subspecies germ plasm which does not seem to have high levels of species incompatibility factors. The third is through the use of complex crosses and exchange of cytoplasms and genomes to obtain compatible crosses. A new Cooperative Grant Project request for this interspecific hybridization work has been submitted to the USDA, Competitive Grant Office for 1979-81. Should this Project be funded, it will provide for research parallel to that of the present project to make full use of the disease resistance to be found in species other than P. vulgaris and at no additional cost to the Contract.

Michigan. Research at Michigan State University has been particularly involved in increasing yields through improved plant (habit) types, broadening of the genetic base through use of tropical germ plasm and resistance to bacterial blight. We have been in close contact with Dr. M. W. Adams, plant breeder and Dr. F. Saettler, plant pathologist, on this work and have sent resistant lines and advanced materials for trials and use in breeding. Cooperative work is now focused on inves-

tigation of the inheritance of plant type, yield and disease resistance. Crossing and seed increase have taken place in Puerto Rico and F_2 and BC_1 progeny will be studied in Michigan in the coming season. It is hoped that appropriate plant types can be correlated to yield and that linkages, especially those related to disease resistance, can be identified for future breeding.

Others. Active participation in the research activities and annual meetings of the bean scientists composing the Western Regional Project, W-150, will also be continued to give this Project's results and germ plasm the broadest exposure to US bean scientists.

Through the normal linkages, the project personnel will continue to be kept abreast of bean/cowpea research developments in relation to Title XII, by active participation in the preplanning and planning stages being carried out at Michigan State University.

E. Project Description and Background

Improvement of beans and cowpeas for resistance to tropical diseases was initiated in 1969 at the then Federal Experiment Station at Mayaguez (now Mayaguez Institute of Tropical Agriculture) as an in-house USDA Project. In 1970 it became a PASA Project between USDA and AID. In 1973, work on improvement of tropical production of beans and cowpeas through disease and insect control was also initiated at the University of Puerto Rico through a research contract with AID. A cooperative agreement between USDA and the University of Puerto Rico integrated in 1974 the MITA and UPR components into a single project managed by the University.

In these early years it was felt that beans and cowpeas were probably the most important protein crops for the tropics. It is in the Tropical areas, however, that the value of disease resistance is especially important since no control measures are normally used and diseases and insects build up year to year due to repetitious cropping systems. The use of multiple disease resistant beans/cowpeas with good yield potential would greatly assist the small rural farmer to increase and stabilize national bean production. This is our goal. To accomplish this goal the project has surveyed the crops in major production areas of Latin America during the early years, collected germ plasm continuously and screened it by field and laboratory methods.

In the screening of germ plasm and the breeding for multiple disease resistance, the establishment of recurrent selection populations (RSPs) with the help of natural field outcrossing by the carpenter bee (Xylocopa brasilianorum) and relatively low selection pressure has resulted in a number of materials with high levels of disease resistance. In all the populations where a high level of tropical germ plasm prevails, appreciable amounts of general disease resistance ('rusticity' or multiple genes of survival value such as are often found in 'land' races or native cultivars) have been accumulated (e.g., to root rots and bacterial blights). In addition, major gene resistance sources, as well as multiple gene resistance of additive nature (horizontal resistance) sources have also been obtained for some diseases (viruses and rust). Since these populations are often highly variable, frequently of unusual seed colors and do not always combine the disease resistances with other highly desirable agronomic characteristics, the

project has been using a modified recurrent selection technique (manual crossing, pedigree control and selection in F_2 and F_3 at each cycle) to obtain acceptable commercial types with high levels of multiple disease resistance for the major tropical bean production areas.

The basic objectives of the virology phase of the Project were accomplished. Rugaceous (whitefly-transmitted) and other viruses capable of infecting beans and other edible legumes were characterized through conventional procedures. Particles of the bean golden mosaic virus (BGMV) and of the Euphorbia mosaic virus (EMV) were, in addition, visualized under the electron microscope. A method which permits high transmission rates of some of these viruses via mechanical inoculation was developed. Studies with the BGMV at the University of Puerto Rico facilitated nucleic acid research with the virus at the University of Illinois.

The Project has developed chemical control methods to protect the bean and cowpea crops from pathogens and insects when resistance is not available or when it occurs at low levels. It is anticipated that technology developed in Puerto Rico could be applicable in areas where problems and environmental conditions are similar those encountered in the Island. In the area of diseases, control of the major foliar pathogens of beans and cowpeas and the major soil-borne fungi attacking beans has been achieved. Powdery mildew (Erysiphe polygoni), target spot (Corynespora cassiicola), and leaf spot (Cercospora cruenta and C. canescens) of cowpea were controlled with benomyl, mancozeb, dinocap and chlorothalonil applied at various rates. Angular leaf spot (Isariopsis griseola) and rust (Uromyces appendiculatus) of beans were controlled with benomyl, mancozeb and chlorothalonil. Rust was controlled also via the systemic

fungicides oxycarboxin and triforine. Copper hydroxide and mancozeb controlled bacterial blight (Xanthomonas spp.). Treatment with chloroneb and hexachlorophene controlled soil-borne pathogens (Rhizoctonia macrosclerotia, Sclerotium rolfsii, Macrophomina phaseolina and Fusarium spp.). Noxious insects of beans and cowpeas were also controlled via conventional products. Endosulfan controlled the cowpea weevil (Callosobruchus chinensis) and the cowpea curculio (Chalcodermus ebeninus). Leafhoppers (Empoasca spp.) were controlled with carbofuran, methomyl and disulfotan. Oxamyl was effective against leafminers (Lyriomiza spp.) in the greenhouse. Treatment with cooking oils protected bean and cowpea seeds from weevils for six months.

F. Management Considerations

No unusual management problems are expected to arise in connection with this project extension. It is similar in concept and design to the previous centrally funded contract under the same title. However, it is important that project management monitor closely the strengthening of the network of cooperators in LDCs, the on-site research training activity and the follow through on the planned publication schedule.

G. Project Design and Outline of Work

Objective 1. To screen new materials for locating additional sources or types of disease resistance such as the 1978 Phaseolus collections from Mexico and Guatemala, and the cowpea collections from IITA.

Work Plan

a. Increase in low disease incidence field locations, using chemical control assistance if necessary, or in greenhouse, as many as 1,000-2,000 lines for preliminary screening.

b. Include short, 3-5 m, non-replicated rows for preliminary trials and 2 to 3 replicates for subsequent plantings as adjuncts to normal field disease screening trials at Fortuna, Mayaguez, Isabela, Adjuntas and Lajas, according to season. Plantings include standard varieties every 10 rows. Trials are often run concurrently at several locations -- no lines are eliminated until having been screened at several locations. Frequent readings of incidence and intensity of the various diseases is used for evaluation of the lines. Worthless plants are rogued. (Note: All of these locations have a very high continued incidence of many diseases and races which is also increased by planting spreader cultivars for uniformity of inoculation.)

c. Promising selections from field trials are planted in the greenhouse and inoculated to confirm resistances. Evaluation is based on severity of symptoms expressed according to disease type and pathogen strain or race. The effects on plant organ development, on yield components and frequency among plants tested are considered in the evaluation.

Objective 2. Continue to develop recurrent selection populations (RSPs) for high frequency of major and minor genes for multiple resistances. There

are two types of RSPs being used by the project: I. Multiple disease resistance RSPs by field crossing, and II. Modified RSPs by manual crossing for combining multiple disease resistance, agronomic characteristics and quality factors.

Work Plan I. Multiple disease resistant RSPs -- field crossing.

a. Four-five hundred lines which have passed preliminary screening and are in various stages of recurrent selection are planted in pedigree rows. Usually 2-3 plantings of the same line are made per year alternating at different locations.

b. Crossing at each planting occurs in lines and between lines by carpenter bees (Xylocopa brasilianorum), estimated to be from 0-30%, depending on location and bee frequency.

c. Rogueing of each line at each screening to eliminate highly susceptible plants before flowering.

d. Selection of outstanding segregants and new sources for greenhouse testing, especially for viruses; bulk reminder to continue line in subsequent field planting.

e. Greenhouse tested resistant plants returned to RSPs as new lines for subsequent field planting and to both Objective 2 -- Work Plan II and Objective 3.

Principal emphasis of this stage of the work is to obtain an accumulation of useful genes, both major and minor, for specific and general resistance in the overall population represented by the lines and to eliminate deleterious genes or gene combinations. It is extremely important to this work that uniform and continuous disease pressure and selection is maintained for many diseases. We feel this has been obtained in Puerto

Rico by the use of the several substation locations and in our estimation could not be duplicated at any other location or by any conceivable use of environmental chambers on inoculation systems.

Work Plan II. Modified RSPs -- manual crossing (Example: V Cycle -- 1979; Figures 1 and 2; and Table 1).

a. Crossing Block - Superior selected materials to be manually crossed in all combinations. In the V Cycle the superior materials were:

F_1s from cycle IV	-	17 selected
F_3s from cycles I to III	-	1 selected
F_4s from cycles I to III	-	52 selected
		70 total

Since the total number of possible crosses is so large those crosses of most interest are attempted first: usually this involves crossing F_1s with F_4s, then crosses within the F_1 group and then crosses within the several seed and plant type groups of the F_4s, followed by other crosses. Usually between 600-800 good filled pods of a similar number of crosses are obtained. Records are kept of all pedigrees and crosses by assigning a yearly code number to all lines.

b. Increase F_1 seed in Fortuna by field planting of 3 seed units of each hybrid (residual seed is maintained on reserve in case of crop loss and for use in the subsequent crossing block) at 1 x 1 m spacing with 1 corn plant and 1 bean seed per hill. The corn plant serves as a support for vining plants and protects smaller plants from wind action. All inferior (weak, diseased or aberrant) crosses are eliminated. No special field plot design is used.

NOTE: Since no adapted corn varieties appropriate for this use

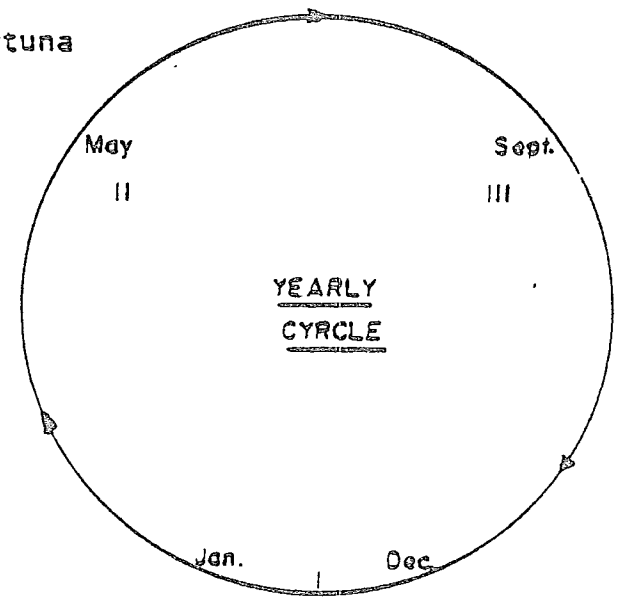
Fig. 1.-Plant breeding operations taking place during the year. Manual II.

II. Increase & Selection

F_1 & F_3 - Fortuna

III. Extensive Trials

Cooperators - F_4



I. Cross, Selection & Test

x - Greenhouse

F_2 & F_4 - Adjuntas

F_4 - Fortuna

F_4 - Isabela

Fig. 2.-RSPs - Breeding procedure diagram. Manual II.

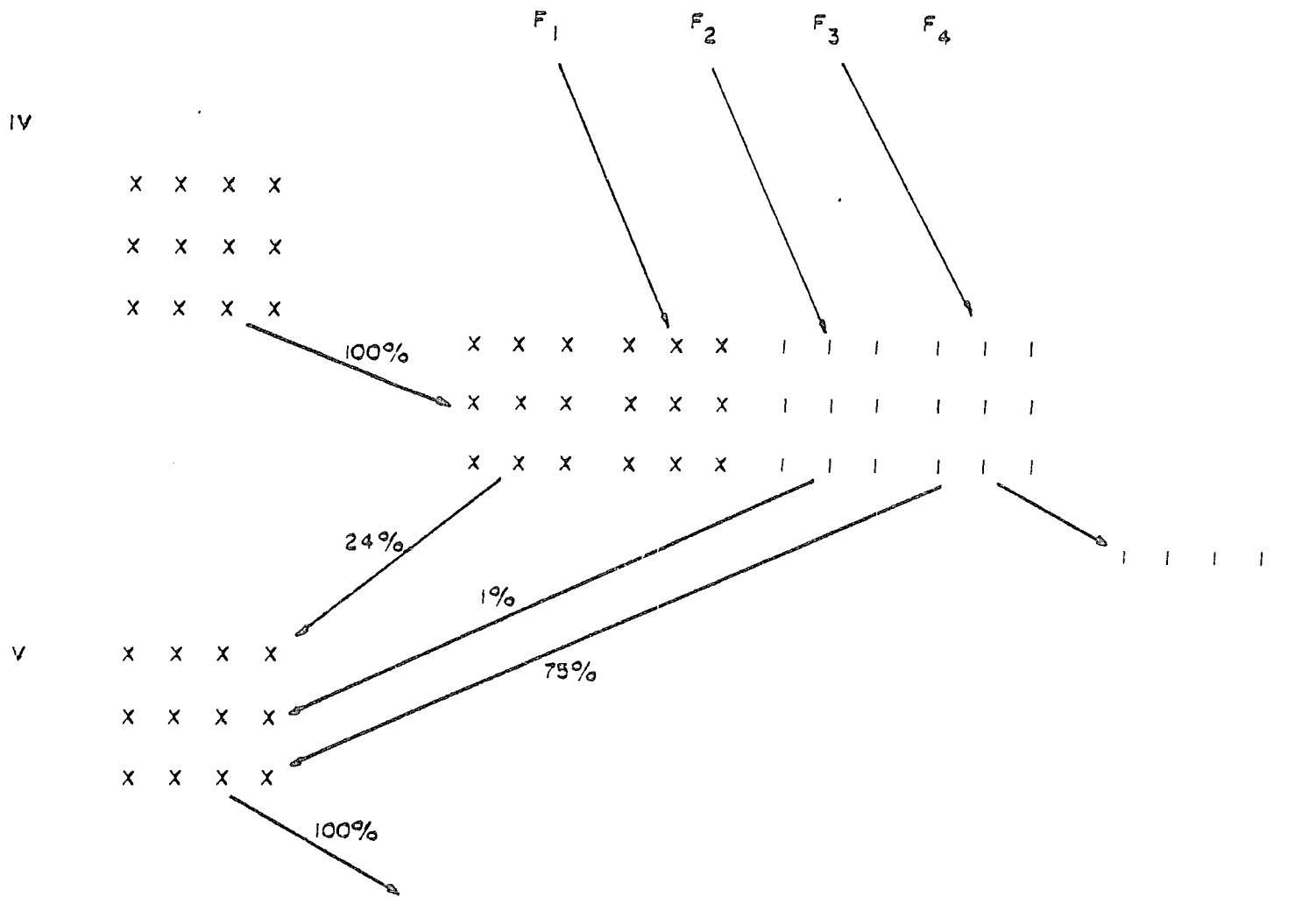


Table 1.-Make-up of crossing block - V Cycle. Manual II.

Generation	Number of lines from each cycle				
	I	II	III	IV	
F_1				17	24%
F_2					
F_3	1				1%
F_4	16	4	32	--	75%
	24%	6%	46%	24%	100%

to us by CYMMT as stiff stemmed, strong disease resistant root stalks and relatively low plant types, which have provided exceptionally good supports for the vining bean germ plasm without competing excessively with bush types at the low density we are using.

c. Plant F_2 generation in Adjuntas using selected materials from F_1. Usually the majority consist of the best 10% of the Fortuna planting determined on the basis of disease resistance (bacteria and viruses), vigor, plant and seed type and seed yield (over 100 grams/plant). However selection of some 10% of the F_1s is made from F_1s judged intermediates on the above criteria, but because of particular pedigrees we feel it advisable to continue through the F_2s selection.

Approximately 120 seeds of each F_2 line are space planted in 1 m rows at 20-25 cm over the row. Hybrids likely to produce vining plants, as determined from the F_1 generation and the pedigree are planted alternating with corn plants at 25 cm spacing. These rows are alternated with several rows of types likely to be of bush habit which are planted at 20 cm between plants. No special field plot design is used.

In the Adjuntas area a very high incidence of rust, virus and other diseases has been present each year. Susceptible plants or families can be completely killed before harvest time. About 10% of the population will show very high levels of multiple resistances, another 10% generally show susceptibilities of an intermediate level to one or another disease, the rest generally show complete breakdown of resistances, usually from a combination of poor parents.

Resistant plants are labelled 2-3 times during the season in-

notes are taken for superior families. Final selections are based on resistances, vigor, plant type and yield per plant.

d. Plant superior F_3s in Fortuna for selection for tolerance to bacteria, uniformity, plant type and yield. Since this planting takes place during long days, sensitivity to day length can be identified and eliminated. A randomized block with one replication is utilized. Corn with vining types is alternated with rows of beans of the bush types. The presence of rows of corn reduces somewhat the intensity of bacterial blight incidence, however even then, very susceptible lines may be killed by this disease before harvest. Plots are single rows 5-meter long. One hundred seeds are used for each line being tested. Five-six hundred selections are included in the trial and compared with parental standards. Superior lines are judged by "F" test and covariance analysis.

Superior lines for uniformity, plant type, vigor, disease resistance and yield are selected (usually about 10% of the planting) for multiple location testing in the F_4 generation.

Objective 3. Continue to develop and release breeding lines for high levels of multiple disease resistance.

Work Plan

a. Outstanding lines are identified from advanced generations of RSPs and greenhouse inoculation tests.

b. Compare new disease resistant lines at several locations for general agronomic usefulness with best standards using randomized block trials (4 reps, carried out within type -- blacks, whites, colored and miscellaneous). These plantings also serve to increase seed for release.

Plots are usually 4 rows of 3 meters and full plots are harvested for yield estimates.

c. Release as breeding lines those lines maintaining superior levels of new resistances or of multiple disease resistances, and similar or superior to type standards in agronomic characteristics and enter into crossing block (Objective 2, Work Plan II).

Objective 4. Select, test and release advanced lines for combined multiple disease resistance, yield and commercial potentials.

Work Plan

a. Test the best 5-10% of the F_4 generation selections for multiple disease resistance, agronomic characteristics and preliminary comparison by multiple location trials (Adjuntas, Fortuna and Isabela). Usually a balanced lattice of 4 reps or a triple lattice repeated is used for the field plot layout. Plots consist of a single 2 meter row at 1 meter row spacing, planting 10 seeds per meter. This has given us C.V.'s around 0.20 and significant differences between varieties for yields and disease readings.

b. Distribute best selected lines to Cooperators for more extensive trials.

c. Test best lines in greenhouse by inoculation to substantiate levels of disease resistance. Since the purpose of these particular trials is to identify the best advanced lines for a combination of multiple disease resistances and agronomic characteristics for possible use in bean production areas of the tropics, the concurrent use of the 3 locations provides a good insight into their probable capabilities in the tropics. Adjuntas, in the mountains, is a very high disease incidence location

and yields here generally are lower as a consequence. Fortuna, at sea level, is a low disease incidence location, and though insects, bacterial blight and viruses are present, yields are very high and indicate a line's yield potential. Isabela, in an intermediate location, but with different soils and climate from the previous two, serves to obtain a third location for balance. A study of the combined analyses, in light of consideration of the results from the individual locations, makes it easy to identify the advanced lines with the best combination of characteristics for commercial use.

The University of Puerto Rico is aware of the commercial potential of several of the Project's advanced lines and is taking steps to conduct more extensive trials[1/]. This type of extension research should be undertaken by the national programs in the major bean production areas using various planting dates, and other agronomic practices due to the considerable plant habit and blooming season modifications which have occurred due to our selection.

NOTE: As an offshoot of the cooperation with the University of Wisconsin on protein and yield, a new research program on the nutritional aspects will make it possible to include another component, i.e., to better protein yields and reduce anti-nutritional factors, not only at the final stage preceding release and distribution, but also througnout the breeding and selection stages in the advanced lines. This component would be at no additional cost to this research contract since it will be supported by Section 406 TAD funds.

1/ The Project's elite materials can be very useful in the improvement and expansion of traditional bean culture, and may become the germ plasm foundation for the commercial, fully mechanized, dry bean in-

Objective 5. Continue to develop RSPs in closely related Phaseolus species for important disease resistances not presently found in the common bean, specifically, bacterial blights (Xanthomonas spp.), angular leaf spot, necrotic strain of BCMV, BGMV and soybean rust.

Rationale: Each of the diseases mentioned above, by itself, either seriously lower yields, or potentially could, in certain major bean production areas. As an example, bacterial blights are a serious foliar disease of the common bean, and are found in the major bean production areas of the US.

Bacterial blight reduces yields though defoliation and as yet no resistance has been incorporated into US varieties, and is also seed-transmitted. No resistance is found in the common bean, but very high levels of resistance have been found in P. coccineus, a cross pollinated species with which the common bean is somewhat cross compatible, indicating the feasibility of gene transfer to confer resistance into the common bean. Preliminary work with the cooperation of the University of Florida on the transfer of bacterial blight resistance from P. coccineus to the common bean shows that a large proportion of the fertile plants in F_2 and BC_1 progeny contain a very high level of the original resistance from P. coccineus.

In order to transfer multiple resistances from coccineus to vulgaris it is important to obtain high gene frequencies approaching homozygocity for the resistance factors in coccineus due to the normal cross pollination reproductive system of this species. In this way the time required for multiple gene transfer can be considerably shortened.

Work Plan I. P. coccineus

a. Manually cross, in the greenhouse, lines selected for multiple resistances screened from large germ plasm collections or from new collections.

b. Plant F_1 progeny in greenhouse and clone to produce 10-15 duplicate sets.

c. Transplant original F_1 plants to field isolated crossing block in Adjuntas.

d. Screen F_1 clones in greenhouse for multiple resistance by inoculations.

e. Transplant resistant plants from screening tests for different diseases to semi-isolated field plots for field crossing.

f. Harvest periodically from field crossing blocks using final harvests (after less resistant plants have succumbed at senility, about 24 months) for new generation.

g. Repeat procedure.

Work Plan II. Transfer to P. vulgaris

a. Cross resistant selections from inoculation step d, above, into RSPs (see Objective 2, Work Plan II, step a).

b. Continue selection in F_2 under high disease incidence (artificial inoculation) to intensify selection pressures for resistance, and follow through as in Objective 2, Work Plan II.

Objective 6. To confirm levels of insect resistance and their economic significance for the proyect's advanced lines.

Work Plan

a. Plant selected materials in 6 sq m plots arranged in completely

randomized block design with four replicates, including in the trial insecticide treatment and no treatment and known susceptible and resistant (when available) standards.

b. On beans, collect data periodically on leafhopper nymph populations, leafhopper symptoms, bean beetle and leafminer damage and bean weevil infestation.

c. On cowpeas, make periodic samplings for damage from cowpea curculio, leafminer, bean beetle, and cowpea weevil.

Objective 7. To confirm effectiveness of fungicides for controlling soil-borne bean pathogens.

Work Plan

a. Plant trial at one location (Lajas) at the beginning of the rainy season on an area of 0.10 ha.

b. Use a resistant and a susceptible cultivar, 2 fungicides, each at 3 rates of application and untreated check; replicate treatment 5 times.

c. Use disease index and yield as efficacy criteria.

Objective 8. Evaluate microorganisms in the field for controlling foliar and soil borne pathogens.

Work Plan

a. Plant trials, using two bean cultivars at two locations (Lajas and Adjuntas) on an area of 0.06 ha in a randomized block design with 8 treatments and 5 replicates; include untreated check and a check protected with a proven effective fungicide.

b. With foliar pathogens, plant inoculum spreader rows in advanced of experimental plants; and if necessary inoculate artificially.

c. Raise antagonistic microorganisms in the laboratory and apply to foliage or soil according to treatment.

d. Rate efficacy of treatments by disease index and yield.

Objective 9. To strengthen the network of cooperators in LDCs and of principal scientists in the US who will be interested in receiving and using disease resistant germ plasm, and who will participate in trials of improved disease resistant lines in the principal bean production areas.

Work Plan

The project's network of cooperators is described in pages 14-17 under Section D, Plans to Develop Linkages and to Facilitate the Utilization of Research. To strengthen this network, specially in Central America and the Caribbean, it is proposed to add an agronomist to the Project staff, whose major responsibilities would be to promote a more fruitful working relationship with cooperators through in-country personal contacts with them and to provide a follow-up on the Project's materials shipped to cooperators via diplomatic pouch. This follow-up would consist, essentially, of picking seed packages at in-country AID missions, and delivering these to cooperators; assisting cooperators in establishing field trials (statistical designs to be approved by UPR Agricultural Experiment Station biometricians); working with cooperators in the field during progress of the trials, if needed; and obtaining data from cooperators as soon as trials are harvested. The outreach agronomist would also be expected to provide solutions, in-country, to incidentals that may jeopardize the program.

A modest budget, assigned to the Project in Puerto Rico, should be made available to the agronomist to provide financial assistance to cooperators in furtherance of the goals and objectives of the outreach program.

Details on the countries to visit and the number of trips per country are given in the outreach agronomist budget (Appendix A, page 6).

Objective 10. Provide training on-site in Puerto Rico to cooperators from LDCs to improve scientist-to-scientist working relationships, increase uniformity of procedures and update research skills.

We have envisioned two types of training we believe to be complementary to that provided by CIAT. In the first, we would expect to provide an on-site experience in Puerto Rico to professionals selected from Central America, the Dominican Republic and Haiti to continue cooperative research with the Project in their country. In this way they would learn procedures that we utilize, update their expertise in particular specialties (Phytopathology, Entomology, or Plant Breeding), and thus return to their countries with capabilities of providing uniform and reliable results in cooperative work. This type of training would have to be organized to fit the needs of the individual scientist and would require relatively short periods, from 2-4 weeks to work directly with our project personnel at appropriate times of the year. Project cooperators contacted during the 1979 PCCMCA meeting in Tegucigalpa, Honduras, considered this as an worthwhile endeavor to strengthen ties between the Project in Puerto Rico and in-country cooperators.

We plan on inviting only seven scientists from this areas (one per country), since convenient times would have to be found when the national scientist could leave his own work, coinciding with a time when adequate field training could be accomplished in Puerto Rico.

In the second, intended for potential cooperators from some English speaking Caribbean countries, a region not covered by CIAT, the in-service

training (apprenticeship type) will be more general in nature to cover major aspects of bean/cowpea production (varieties, soil preparation, planting, irrigation, diseases and insects, harvest and storage) and an introduction to bean/cowpea breeding methodology. We propose to train four persons during 6-month periods, to cover both the tropical rainy and the dry season. To be eligible for training, candidates must be government employees with a firm commitment to return, after training, to a program of edible legumes. Authorities from regional agricultural organizations (from CARDI in Jamaica and IICA in Guiana), contacted in the Dominican Republic during the February 1979 Expert Consultation on Edible Grain Legume Production in Central America, the Caribbean and Panama, expressed interest in this type of cooperation.

Objective 11. To hold a symposium of identification, distribution and potential for control of diseases and insects of beans and cowpeas.

A symposium to cover the subject of Identification, Distribution, and Potential for Control of Major Diseases and Insect Pests Affecting Production of Beans and Cowpeas in Tropical America is tentatively planned for February 1980. As suggested by the evaluation team (June 1978), contributors should be leading scientists in the fields to be covered. This will include Project staff members, scientists from the Caribbean, Central America, South America, Africa (IITA) and the United States. The assembled, properly illustrated, papers will constitute a publication that will fulfill the contractual obligation for a disease/insect monograph. A budget to cover the symposium expenses is submitted (Appendix A, page 8).

H. Time Phased Work Plans

	1979	1980
1. Screening (continuous)		
New Germ Plasm Collections	----------▶	
2. RSPs - field crossing (continuous)	----------▶	
RSPs - manual crossing (continuous)	Cycle V ---▶	Cycle VI
3. Release - breeding lines (continuous)	----------▶	
4. Release - advanced lines		
To Cooperators for Trials (continuous)	----------▶	
Formal variety releases	1st set	2nd set
5. RSPs - other species		
P. coccineus	Cycle II----------▶	
6. Chemical control research	-------▶	
7. Biological control research	-------▶	
8. Insect resistance evaluation	----------▶	
9. Training		
Specific	----------▶	
Broad	----------▶	
10. Outreach (continuous)	----------▶	
11. Cooperative research		
IITA (continue)	----------▶	
CIAT (continue)	----------▶	
US (major efforts)		
USDA (continue)	----------▶	
Wisconsin (new protein)	Start----------▶	
Florida (new interspecific crosses)	Start----------▶	
Michigan (continue)	----------▶	
12. Symposium	-▶	

I. Contractor Internal Management and Facilities

1. Research Organizations Involved

a. Agricultural Experiment Station, UPR, Mayaguez Campus, R. Abrams, Director.

b. Department of Crop Protection, UPR, Mayaguez Campus, A. Ayala, Director.

c. Mayaguez Institute of Tropical Agriculture, F. W. Martin, Location Leader.

2. Facilities

Facilities and equipment for conducting the types of research described in this proposal are available at the University of Puerto Rico and at MITA, except for a small tractor with precision planter. These include laboratories, greenhouses and the research Substations of Isabela, Lajas, Fortuna and Adjuntas, all strategically located in distinct ecological zones of the Island.

J. Key Personnel

1. Julio H. López-Rosa, Project Director

A. Education

Institution	Year	Degree	Field
University of Puerto Rico	1953	BSA	Agronomy
Louisiana State University	1957	MS	Plant Pathology
North Carolina State Univ.	1964	PhD	Plant Pathology

B. Experience

Research Assistant in Agronomy, UPR	1953-55
Assistant Phytopathologist, UPR	1957-61
Associate Phytopathologist, UPR	1964-70
Phytopathologist, UPR	1970-present
Director, Plant Pathology and Botany, UPR	1973-77

C. Languages

Spanish and English

D. Principal Publications

1. Adsuar, J., and J. H. López-Rosa, 1962. Effect of hot water treatment for the control of ratoon stunting disease on the germination of some commercial sugarcane varieties. J. Agric. Univ. P.R. 46: 83-86.

2. López-Rosa, J. H., and R. T. Sherwood, 1966. Symptoms and host-parasite relations in the tar spot disease of lespedeza caused by Phyllachora lespedezae. Phytopathology 56: 1136-1142.

3. López-Rosa, Julio H., 1969. Phoma sp., the causal agent of pigeon pea canker. (Abstract.) Phytopathology 59: 1348.

4. López-Rosa, Julio H., and J. Adsuar, 1970. The effect of the ratoon stunting disease on the yield of some sugarcane varieties in Puerto Rico. J. Agric. Univ. P.R. 54: 149-160.

5. Bird, J., J. Sánchez, and J. H. López-Rosa, 1970. Whitefly-transmitted viruses in Puerto Rico. (Abstract). Phytopathology 60: 1539.

6. Bird, J., and J. H. López-Rosa, 1974. New whitefly and aphid-borne viruses on bean Phaseolus vulgaris in Puerto Rico. Proc. Grain Legumes Workshop, IITA, Ibadan, Nigeria: 276-278.

E. Amount of Time on Project

Sixty percent

2. George F. Freytag

A. Education

Institution	Year	Degree	Field
University of Wyoming	1948	BA	Botany
Washington University (St. Louis, Mo.)	1950	MA	Botany
Washington University (St. Louis, Mo.)	1955	PhD	Botany & Genetics

B. Experience

Teaching Assistant, Wash. Univ.	1948-50
Substitute Teacher, Escuela Agrícola Panamericana, Honduras, C.A.	1950-52
Administrative Research Assistant, Missouri Botanical Garden	1952-53
Temporary Scientific AID, Rockefeller Foundation, Mexico	1953-55

Chief Agronomist and Associate Prof., Ministry of Agriculture, Nicaragua	1956-57
Prof. of Agronomy and Genetics and Head, Department of Agronomy, Escuela Agrícola Panamericana, Honduras, C.A.	1958-72
Prof. of Agricultural Education and Chief of Party, University of Wisconsin Contract, Brazil	1972-74
Agricultural Specialist, University of Wisconsin	1974
Research Geneticist, Mayaguez Institute of Tropical Agriculture (USDA), Puerto Rico and Prof. of Plant Breeding (Ad Honorem), UPR	1974-present

C. Languages

English and Spanish

D. Principal Publications

1. Freytag, G. F., 1975. Research related to the origin and movement of the common bean (Phaseolus vulgaris L.). In: Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.), Academic Press, N.Y., pp.158-163.

2. Freytag, G. F., 1975. Breeding beans for the tropics. In: Proc. XXI Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), San Salvador, El Salvador: 97-104.

3. Freytag, G. F., 1978. Improved plant type of some advanced bean lines (P. vulgaris L.) developed in Puerto Rico (in Spanish). In: Proc. XXIV Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), San Salvador, El Salvador (L-18): 1-8.

4. Freytag, G. F., 1978. Field test in Puerto Rico of advanced bean lines (P. vulgaris L.) developed in Puerto Rico (in Spanish). In: Proc. XXIV Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), San Salvador, El Salvador (L-17): 1-8.

5. Freytag, G. F., 1979. Metaxenia en el frijol (Phaseolus vulgaris L.). In: Proc. XV Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), Tegucigalpa, Honduras. (Paper presented and submitted for publication.)

6. Freytag, G. F., 1979. Pruebas de campo en tres localidades con líneas avanzadas de frijol desarrolladas en Puerto Rico. In: Proc. Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), Tegucigalpa, Honduras. (Paper presented and submitted for publication.)

E. Amount of Time on Project

One hundred percent

3. Pedro L. Meléndez

A. Education

Institution	Year	Degree	Field
University of Puerto Rico	1960	BSA	Agriculture
North Carolina State College	1965	MS	Plant Pathology
North Carolina State University	1970	PhD	Plant Pathology

B. Experience

Research Assistant in Horticulture, UPR	1960-63
Assistant Phytopathologist, UPR	1965-67
Associate Phytopathologist, UPR	1970-76
Phytopathologist, and Prof. of Plant Pathology, UPR	1976-present

C. Languages

Spanish and English

D. Principal Publications

1. Meléndez, P. L., and N. T. Powell, 1967. Histopathological aspects of the Fusarium wilt-root knot complex in flue-cured tobacco. Phytopathology 57: 286-292.

2. Meléndez, P. L., 1968. A Cercospora leaf spot of acerola in Puerto Rico. J. Agric. Univ. P.R. 52: 71-73.

3. Powell, N. T., P. L. Meléndez, and C. K. Batten, 1971. Disease complexes in tobacco involving interactions between Meloidogyne incognita and certain soil-borne fungi. Phytopathology 61: 1332-1337.

4. Meléndez, P. L., and J. Bird, 1971. Corynespora leaf spot of papaya (Carica papaya L.) in Puerto Rico. J. Agric. Univ. P.R. 55: 411-425.

5. Meléndez, P. L., Rocío del Pilar Rodríguez, and J. H. López-Rosa, 1977. Chemical control of fungus diseases of beans and cowpeas in Puerto Rico. Proc. Amer. Phytopath. Soc. 4: 179.

6. Kaiser, W., and P. L. Meléndez, 1978. A Phytophthora stem canker disease of pigeon pea in Puerto Rico. Plant Dis. Reptr. 62: 240-242.

E. Amount of Time on Project

Thirty percent

4. Carlos Cruz-Ramos

A. Education

Institution	Year	Degree	Field
University of Puerto Rico	1963	BSA	Agriculture
Rutgers University	1968	MS	Entomology
Rutgers University	1972	PhD	Entomology

B. Experience

Agricultural Extension Agent, UPR	1963-65
Research Assistant, UPR	1965-66
Graduate Research Assistant in Entomology, Rutgers	1966-68
Research Assistant in Entomology, UPR	1968-72
Assistant Entomologist, UPR	1972-76
Associate Entomologist, UPR	1976-present

C. Languages

Spanish and English

D. Principal Publications

1. Cruz, C., 1970. Tephrosia seed infestation and losses caused by the lima-bean pod borer Etiella zinckenella (Treit.). J. Agric. Univ. P.R. 54: 585.

2. Cruz, C., 1974. Insecticidas para el control del saltahojas en habichuelas tiernas. Adelanto Científico Núm. 7, Abril 1974, Estación Experimental Agrícola - UPR.

3. Cruz, C., 1975. Observations on pod borer oviposition and infestation of pigeonpea varieties. J. Agric. Univ. P.R. 59(1): 63-68.

4. Cruz, C., 1975. Chemical control of the leafhopper (Empoasca fabae (Harris) on snapbeans. J. Agric. Univ. P.R. 59(1): 32-84.

5. Cruz, C., 1975. Daño y combate de insectos en el frijol común, Phaseolus vulgaris y en el frijol de costa, Vigna unguiculata. Memoria XXI Reunión Anual PCCMCA, Abril 1975, San Salvador, El Salvador, pp. 241-249.

6. Cruz, C., 1976. Resistencia del frijol, Phaseolus vulgaris a Empoasca spp. en Puerto Rico. Memoria XXII Reunión Anual PCCMCA, Julio 1976, San José, Costa Rica, (L-27): 1-20.

E. Amount of Time on Project

Fifty percent

5. Julia S. Mignucci

A. Education

Institution	Year	Degree	Field
University of Puerto Rico	1968	BS	Biology
University of Illinois	1975	MS	Plant Pathology
University of Illinois	1978	PhD	Plant Pathology

B. Experience

Assistant-Microbiology Laboratory, UPR	1966-68
Research Assistant, UPR	1968
Assistant, Introductory Course in Plant Pathology, University of Illinois	1975
Assistant Phytopathologist, UPR	1978-present

C. Languages

Spanish and English

D. Principal Publications

1. Mignucci, J. S., 1977. Development of soybean leaf cultures for the maintenance and study of Microsphaera diffusa. Plant Dis. Reptr. 62: 271-273.

2. Mignucci, J. S., and S. M. Lim, 1977. Effect of powdery mildew on soybean yield. Phytopathology (Submitted).

3. Mignucci, J. S., S. M. Lim, and P. R. Hepperly, 1977. Effects of temperature on reactions of soybean seedlings to powdery mildew. Plant Dis. Reptr. 61: 122-124.

4. Mignucci, J. S., and J. S. Boyer, 1978. Inhibition of photosynthesis and transpiration in soybean infected by Microsphaera diffusa. Phytopathology 68: (In press).

5. Mignucci, J. S., 1978. Powdery mildew of soybeans: epidemiology, disease reactions, and yield loss. Ph.D. Thesis, Univ. of Illinois, Urbana, Ill., 78 pp.

6. Mignucci, J. S. and D. W. Chamberlain, 1978. Interactions of Microsphaera diffusa with soybeans and other legumes.
Phytopathology 68: 169-174.

E. Amount of Time on Project

One hundred per cent.

K. General Appraisal

The 1978 indepth review indicated that progress was being made as planned under the current scope of work. Their recommendations to be included in the scope of work for the proposed extension are as follows:

a. Further development of the outreach program should be developed. Hiring of a full time professional for this should be initiated.

b. Develop a practical 3-9 month training program for LDC scientists.

c. Preparation of manual of diseases and pests.

At the RAC review on January 29, 1979, it was reaffirmed that a new proposal, more tightly written with realistic goals and a schedule of activities should be prepared. The present submission responds to these expectations. The present project proposal for extension responds to RAC guidance for tightening the project up and will focus on termination of the chemical control aspects of the research, proceed with publication of results, and concentrate the projects resources into the breeding and outreach effort.

L. Environmental Considerations

The overall aim of this research project is to increase food availability for the people of the LDCs. It hopes to accomplish this by reducing losses presently caused by diseases and insects. Ideally, the goal of reducing crop losses is to be achieved through development of disease and insect resistant beans and cowpeas. When levels of resistance are inadequate to prevent significant yield losses, chemical control alternatives will be indicated. In the latter case, any possibly adverse environmental effect will be considered before any recommendations are made.

Further, grain legumes properly inoculated fix nitrogen from the air to essentially meet plant requirements. A residual is left on root nodules to reduce the nitrogen requirement for future crops. This results in a lowered requirement for commercial nitrogen, saves fossil based fuels and reduces soil and water pollution. The benefits to be derived from this work are not biased toward any particular economic or social segment of the population of LDCs.

Therefore, typically of crop improvement research projects financed by AID, there are no environmental problems expected from the proposed renewal of this research project nor from adoption of the improved materials.

M. Women in Development

This project has provided, since its initiation and will continue to provide, opportunities for women in biological sciences.

N. Contract Budget and Life-of-the Project Cost Estimates*

Inputs	1 Dec. 1979-30 Sept. 1980 Work/month	Amount
1. Salaries and Wages	195.3	$135,487
2. Fringe Benefits		19,605
3. Indirect Costs		81,292
4. Travel and Per Diem		38,915
5. Materials and Supplies		8,120
6. Publications		3,000
7. Other Direct Costs		4,920
Total		$291,339

Outputs	
1. Identification of new sources of disease and insect resistance	22,258
2. Development of RSPs for multiple resistances.	22,768
3. Development and release of multiple disease resistant breeding lines.	47,015
4. Selection, testing and release of advanced lines with combined multiple disease resistance, yield and commercial potential.	44,586
5. Development of RSPs in closely related *Phaseolus* species for disease resistances not presently found in the common bean.	44,354
6. Confirmation of levels of insect resistance in advanced lines.	22,754
7. Confirmation of effectiveness of soil fungicides.	10,784
8. Evaluation of microorganisms as biological control agents of bean pathogens.	6,817
9. Strengthening of outreach program.	38,450
10. Training of personnel from bean/cowpea national programs.	31,553
11. Organization of a symposium on bean/cowpea diseases and publication of the proceedings.	-
Total	$ 291,339

Global Budget Summary

Item	Activity			
	Regular	Outreach	Training	Total
Salaries and Wages	$117,937	$13,500	$4,050	$135,487
Fringe Benefits	16,297	2,700	608	19,605
Indirect Costs	70,762	8,100	2,430	81,292
Travel and Per Diem	4,800	10,550	23,565	38,915
Materials and Supplies	7,220		900	8,120
Publications	3,000			3,000
Other Direct Costs	1,320	3,600		4,920
TOTAL	$221,336	$38,450	$31,553	$291,339

O. Publications and Presentations

a. Publications

1. Bird, J. and J. H. López-Rosa, 1973. New whitefly and aphid-borne viruses of bean (Phaseolus vulgaris) in Puerto Rico. Proc. First IITA Grain Legume Improvement Workshop, Ibadan, Nigeria: 276-278.

2. Bird, J., J. Sánchez, and N. G. Vakili, 1973. Golden yellow mosaic of beans (Phaseolus vulgaris) in Puerto Rico. Phytopath. (Abstr.) '63(12): 1435.

3. Bird, J., J. Sánchez, and R. L. Rodríguez, 1974. Virus affecting soybeans in Puerto Rico. Proc. of the Workshop on Soybeans for Tropical and Subtropical Conditions held at the University of Puerto Rico, Mayaguez Campus - Intsoy Publication Series, No. 2: 109-111.

4. Bird, J., J. Sánchez, R. L. Rodríguez, A. Cortés-Monllor, and W. Kaiser, 1974. A mosaic of beans (Phaseolus vulgaris L.) caused by a strain of common cucumber mosaic virus. J. Agr. Univ. P.R. 58(2): 151-161.

5. Bird, J., M. Kimura, A. Cortés-Monllor, R. L. Rodríguez, J. Sánchez y K. Maramorosch, 1975. Mosaico de Euphorbia prunifolia Jacq. en Puerto Rico: Transmisión, Hospederas y Etiología. Memoria XXI Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1: 233-234.

6. Bird, J. and K. Maramorosch (Eds.), 1975. Tropical Diseases of Legumes, Academic Press, New York, 182 pp.

7. Bird, J., J. Sánchez, R. L. Rodríguez y A. Cortés-Monllor, 1975. Gama de hospederas de varios virus rugáceos de Puerto Rico. Memoria XXI Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1: 259-260.

8. Bird, J., J. Sánchez, R. L. Rodríguez, A. Cortés-Monllor, W. Kaiser, H. E. Waterworth, and R. H. Lawson, 1975. A vein banding mosaic of beans incited by a strain of cucumber mosaic virus. In Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.): 103-111.

9. Bird, J., J. Sánchez, R. L. Rodríguez, and F. J. Juliá, 1975. Rugaceous (whitefly-transmitted) viruses in Puerto Rico. In Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.): 3-25.

10. Bird, J., 1977. Whitefly-transmitted viruses. In Recent Advances in Virus Research, Academic Press, New York, pp. 55-110.

11. Bird, J., A. C. Monllor, J. Sánchez y R. Rodríguez, 1977. Propiedades de dos virus transmitidos por la mosca blanca Bemisia tabaci Genn. en Puerto Rico. Fitopatología 12(1): 31-32.

12. Bird, J., R. Rodríguez, A. C. Monllor y J. Sánchez, 1977. Transmisión del mosaico dorado de la habichuela (Phaseolus vulgaris) en Puerto Rico por medios mecánicos. Fitopatología 12(1): 28-30.

13. Cruz, Carlos, 1975. Daño y combate de insectos en el frijol común, Phaseolus vulgaris, y en el frijol de costa, Vigna unguiculata. Memoria XXI Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1: 241-249.

14. Cruz, C., 1978. Adelantos en la investigación entomológica en Puerto Rico. Memoria XXIV Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1(L-16): 1.

15. Cruz, C. y E. Cardona, 1979. Aceites vegetales para controlar los gorgojos de legumbres (granos) secos almacenados. (Accepted for publication in the series Adelantos Científicos, Agricultural Experiment Station, UPR).

16. Freytag, G. F., 1975. Research related to the origin and improvement of the common bean (Phaseolus vulgaris). In Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.): 159-163.

17. Freytag, G. F., 1975. Breeding beans for the tropics. Memoria XXI Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), Vol. 1: 97-104.

18. Freytag, G. F., 1978. Ensayos de campo en Puerto Rico con algunas líneas avanzadas de frijol (Phaseolus vulgaris) desarrolladas en Puerto Rico. Memoria XXIV Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1(L-17): 1-8.

19. Freytag, G. F., 1978. Tipo mejorado de planta de algunas líneas avanzadas del frijol (Phaseolus vulgaris) desarrolladas en Puerto Rico. Memoria XXIV Reunión Anual Programa Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador, Vol. 1(L-18): 1-8.

20. Freytag, G. F., 1979. Metaxenia en el frijol (Phaseolus vulgaris L.). In Proc. XV Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), Tegucigalpa, Honduras. (Paper presented and submitted for publication.)

21. Freytag, G. F., 1979. Pruebas de campo en tres localidades con líneas avanzadas de frijol desarrollados en Puerto Rico. In Proc. Annual Meeting of the Central American Cooperative Crop Improvement Program (PCCMCA), Tegucigalpa, Honduras. (Paper presented and submitted for publication.)

22. Goodman, R. M., J. Bird, and P. Thongmeearkom, 1976. Mechanical transmission, purification, and electron microscopy of the agent causing Puerto Rican bean golden yellow mosaic. Proc. Amer. Phytopath. Soc. 3: 247-248.

23. Hirumi, H., M. Kimura, K. Maramorosch, J. Bird, and R. Woodbury, 1974. Ricketssia-like organisms in the phloem of little leaf diseased Sida cordifolia. Phytopath. 64: 581-582.

24. Kaiser, W. J. and N. G. Vakili, 1978. Insect transmission of pathogenic xanthomonads to bean and cowpea in Puerto Rico. Phytopath. 68: 1057-1063.

25. Maramorosch, K., H. Hirumi, M. Kimura, J. Bird, and N. G. Vakili, 1974. Pigeon pea witch's broom disease. Phytopath. (Abstr.) 64: 582-583.

26. Maramorosch, K., H. Hirumi, M. Kimura, J. Bird, and N. G. Vakili, 1974. Diseases of pigeon pea in the Caribbean area: an electron microscopy study. FAO Plant Protection Bull. 22(2): 32-36.

27. Meléndez, P. L. y R. del P. Rodríguez, 1975. Control químico de las enfermedades del frijol (Phaseolus vulgaris, Vigna unguiculata). XXI Reunión Anual del Program Cooperativo Centroamericano para el Mejoramiento de los Cultivos Alimenticios (PCCMCA), San Salvador, El Salvador. (Paper was omitted, by mistake, from the Proceedings.)

28. Meléndez, P. L., R. del P. Rodríguez, and J. H. López-Rosa, 1977. Chemical control of fungus diseases of beans and cowpeas in Puerto Rico. Proc. Amer. Phytopath. Soc. 4: 179.

29. Meléndez, P. L., R. Rodríguez, and L. Lebrón, 1978. Occurrence of Ascochyta phaseolorum in the humid mountainous region of Puerto Rico (Abstr.). Phytopathology News 12(12): 266.

30. Milbrath, G. M., J. Bird, and J. Sánchez, 1975. Isolation of a strain of cucumber mosaic virus from beans in Illinois. In Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.): 115-117.

31. Pérez, J. E. and J. Bird, 1973. A mosaic of Vigna hosei (Craib) Back a common weed in Puerto Rico. J. Agr. Univ. P.R. 57(1): 56-64.

32. Rodríguez, R. L., J. Bird, A. Cortés-Monllor, H. E. Waterworth, M. Kimura, and K. Maramorosch, 1975. A mosaic virus of Canavalia maritima (Bay-Bean) in Puerto Rico. In Tropical Diseases of Legumes, J. Bird and K. Maramorosch (Eds.): 91-101.

33. Vakili, N. G. and K. Maramorosch, 1974. Witch's broom disease caused by mycoplasma-like organisms on pigeon pea (Cajanus cajan) in Puerto Rico. Plant Dis. Reptr. 58: 96.

34. Vakili, N. G., 1974. Survey of cowpea (Vigna unguiculata) diseases in Tropical America. Proc. Amer. Phytpath. Soc. 1: 123.

35. Vakili, N. G., W. J. Kaiser, J. E. Pérez, and A. Cortés-Monllor, 1975. Bacterial blight of beans caused by Xanthomonas pathogenic types from Puerto Rico. Phytopath. 65: 401-403.

36. Vakili, N. G., 1978. Distribution of smut of beans and cowpeas in Tropical America and its possible center of origin. FAO-Plant Protection Bull. 26: 19-24.

b. Theses

1. López-Guadamuz, Miguel. 1977. Identificación de razas fisiológicas de la roya, Uromyces appendiculatus (Pers.) Unger, del frijol (Phaseolus vulgaris) in Puerto Rico. MS Thesis, University of Puerto Rico, Mayaguez Campus.

2. Ruíz-Giraldo, Hernán. 1979. Evaluación de la resistencia de cultivares de frijol común (Phaseolus vulgaris L.) a razas de la roya, Uromyces appendiculatus, identificadas en Puerto Rico. MS Thesis, University of Puerto Rico, Mayaguez Campus.

3. Armijos-Ley, Fernando. 1979. Epidemiología y control de la podredumbre del tallo de la habichuela (Phaseolus vulgaris L.) causada por Sclerotium rolfsii (Curzi) West. MS Thesis, University of Puerto Rico, Mayaguez Campus.

c. Presentations

1. Bird, J., A. Cortés-Monllor, J. Sánchez y R. L. Rodríguez, 1975. Propiedades de dos virus transmitidos por la mosca blanca Bemisia tabaci Genn. en Puerto Rico. Bean Plant Protection Workshop, CIAT, Cali, Colombia.

2. Bird, J., R. L. Rodríguez, A. Cortés-Monllor y J. Sánchez, 1975. Transmisión del mosaico dorado de la habichuela (Phaseolus vulgaris) en Puerto Rico por medios mecánicos. Bean Plant Protection Workshop, CIAT, Cali, Colombia.

3. Hirumi, H., M. Kimura, K. Maramorosch, J. Bird, and R. Woodbury, 1973. Rickettsia-like organisms (RLO) in the phloem of little leaf diseased Sida cordifolia. Second International Congress of Plant Pathology, Minneapolis, Minn.

4. Maramorosch, K., H. Hirumi, M. Kimura, J. Bird, and N. G. Vakili, 1973. Pigeon pea witches' broom disease. Second International Congress of Plant Pathology, Minneapolis, Minn.

5. Vakili, N. G., 1974. Distribution of wild hosts of whitefly transmitted viruses in Tropical America. Workshop on Grain Legume Diseases, Agricultural Experiment Station, University of Puerto Rico, Río Piedras, P.R.

6. Vakili, N. G., 1974. Diseases of beans (Phaseolus vulgaris) in Tropical America. Workshop on Grain Legume Diseases, Agricultural Experiment Station, University of Puerto Rico, Río Piedras, P.R.

7. Vakili, N. G., 1974. Bacterial blight of beans (Phaseolus vulgaris) caused by Xanthomonas phaseoli and X. vignicola in lowland tropics. Workshop on Grain Legume Diseases, Agricultural Experiment Station, University of Puerto Rico, Río Piedras, P.R.

d. Publications in preparation or to be prepared

(a) Articles

Title	Author(s)	Journal
1. Occurrence of *Ascochyta phaseolorum* on leguminous and other cultivated hosts in Puerto Rico.	P. L. Meléndez, Rocío Rodríguez and Ligia Legrón	Phytopathology
2. Identification of physiologic races of the bean rust pathogen, *Uromyces appendiculatus* in Puerto Rico.	H. Ruíz, M. López and P.L. Meléndez	Phytopathology
3. Biological control of bean diseases via antagonistic microorganisms.	Olga Odiot and P. L. Meléndez	Phytopathology
4. Identification of bean seed pathogens and their role in seed quality and germination.	Mirta Rivera and P. L. Meléndez	Phytopathology
5. Epidemiology of stem rot (*Sclerotium rolfsii*) of beans in Puerto Rico.	F. Armijos and	Phytopathology
6. Chemical control of foliar pathogens of cowpea.	P. L. Meléndez and others	Jour. Agr. Univ. Puerto Rico
7. Chemical control of foliar pathogens of beans.	P. L. Meléndez and others	Jour. Agr. Univ. Puerto Rico
8. Vegetable oils for the control of dry seed weevils. (Research Note)	C. Cruz and E. Cardona	Jour. Agr. Univ. Puerto Rico
9. The influence of leafhopper (*Empoasca* spp.) populations on yield of beans (*Phaseolus vulgaris*).	C. Cruz	Jour. Economic Entomology
10. Insecticides and treatment time for the control of leafhoppers (*Empoasca* spp.) on beans (*Phaseolus vulgaris*).	C. Cruz and E. Cardona	Jour. Economic Entomology
11. Infestation of bean and cowpea cultivars with the dry seed weevils.	C. Cruz and E. Cardona	Jour. Economic Entomology

Title	Author(s)	Journal
12. Effect of soil mulches of yield of dry bean. (Research Note)	C. Cruz	Jour. Agr. Univ. Puerto Rico
13. Leguminous hosts of Puerto Rican strain of Phakopsora pachyrhizi. (Passed peer review - submitted to USDA editors.)	N. G. Vakili	Pending
14. Field survey of endemic leguminous hosts of Phakopsora pachyrhizi in Puerto Rico. (Passed peer review - submitted to USDA editors.)	N. G. Vakili	Pending
15. Resistance of scarlet runner bean (Phaseolus coccineus) to soybean rust (Phakopsora pachyrhizi) in Puerto Rico. (Passed peer review - submitted to USDA editors.)	N. G. Vakili	Phytopathology
16. Assessment of scarlet runner bean-soybean rust response. (Passed peer review - submitted to USDA editors.)	N. G. Vakili	Phytopathology
17. Yield loss factor as a standard criterion for the evaluation of tolerance and resistance to diseases. (Peer review).	N. G. Vakili	Pending
18. A field survey of soybean rust-hyacinth bean distribution in Puerto Rico.	N. G. Vakili	Pending
19. Fungicide control of soybean rust.	N. G. Vakili	Pending
20. Effect of temperature on soybean rust development in five leguminous hosts.	N. G. Vakili	Pending

(b) Germ Plasm Releases (submitted for clearance)

Title	Author
1. Naming and release of the multiple disease resistant bean cultivar "CARBON".	N. G. Vakili

Title	Author
2. Naming and release of multiple disease resistant cultivar "MOGOTE".	N. G. Vakili
3. Naming and release of the multiple disease resistant cultivar "CHORRO".	N. G. Vakili
4. Notice to plant breeders of multiple disease resistant white bean germ plasm MITA-6383.	N. G. Vakili
5. Notice to plant breeders of release of multiple disease resistant Scarlet Runner Bean germ plasm.	N. G. Vakili

Note: Dr. N. G. Vakili has additional data for 7-8 significant publications on diseases of beans and cowpeas.

Appendix A

Budget Summaries and Analyses

1. Regular Budget for Period from 1 December 1979 - 30 September 1980

A. Summary

Item	Fiscal Period 1 December 1979 - 30 Sept. 1980 Amount
Salaries and Wages	$117,937
Fringe Benefits	16,297
Indirect Costs	70,762
Materials and Supplies	4,800
Travel and Per Diem	7,220
Publications	3,000
Other Direct Costs	1,320
Total	$221,336

* Repair and maintenance of equipment

. Analysis

1. Level of Effort

Reduced Monthly Level of $25,000
Dec. 1, 1979 - Sept. 30, 1980

Professional Personnel	Effort (m/m)	Amount (9 months)
hytopathologist (Project Leader)	5.4	$ 11,167
hytopathologist	2.7	4,609
hytopathologist 1/	-0-	-0-
ssistant Phytopathologist	9.0	12,948
ssistant Phytopathologist	-0-	-0-
ssociate Entomologist	4.5	7,002
reeder 1/	9.0	-0-
ssistant Horticulturist	0.9	-0-
ssistant Horticulturist	0.9	-0-
ssistant Horticulturist	-0-	-0-
esearch Assistant	0.9	896
esearch Assistant	9.0	7,560
esearch Assistant	9.0	8.995
esearch Assistant	9.0	7,560
esearch Assistant	-0-	-0-
raduate Research Assistant	9.0	2,700
raduate Research Assistant	9.0	2,700
raduate Research Assistant	-0-	-0-
Subtotal	78.3	66,097

Non-Professional Personnel		
gr. Res. Assistant	-0-	-0-
dministrative Secretary	9.0	5,400
dministrative Secretary	-0-	-0-
dministrative Secretary	9.0	5,400
dministrative Typist	9.0	4,590
dministrative Typist	-0-	-0-
Subtotal	27.0	15,390

1/ SEA, USDA, no charge to Contract

Reduced Monthly Level of $25,000
Dec. 1, 1979 - Sept. 30, 1980

	Effort (m/m)	Amount (9 months)
Labor	81	$36,450
Fringe Benefits - Salaries		16,297
Fringe Benefits - Wages		5,468
Indirect Costs		70,762
GRAND TOTAL	186.3	$210.464

2. Travel and Per Diem

Summary of Travel Plan

Destination	Number of travellers	Duration (days)	Purpose	Cost
Period 1 Dec 1979 - 39 Sept. 1980				
1. Domestic				
Puerto Rico	--	--	Work in field, meetings	$3,600
2. Domestic				
Washington, D.C.	1	7	Attend IX International Congress of Plant Protection	726
3. Foreign				
a. Venezuela	2	7	Attend Annual Meeting of American Phytopathological Society - Caribbean Division	1,494
b. Guatemala	2	7	Attend XXVI Annual Meeting of PCCMCA	1,400
			Total	$7,220
			Total	

3. Supplies (Expendable Materials and Supplies)

	Amount 1 Dec. 1979 - 30 Sept. 1980
1. Laboratory Materials and Supplies	1,200
2. Greenhouse Materials and Supplies	1,800
3. Field Materials and Supplies	1,800
Total	$ 4,800

II. Outreach Budget (1 Dec. 1979 - 30 September 1980)

A. Summary

Item	Amount
Salaries	13,500
Fringe Benefits	2,700
Indirect Costs	8,100
Travel and Per Diem	10,550
Other Direct Costs	3,600
Total	$38,450

B. Analysis

1. Level of Effort

Level of Effort	Monthly Salary	Effort (m/m)	Amount (9 months)
--Agronomist	$ 1,500	9.00	$13,500

2. Travel and Per Diem

Summary of Travel Plan

Destination	Number of trips	Average duration of trips (days)	Purpose	
A. Domestic				
1. Puerto Rico	--	--	Work in field; meetings	$ 900
B. International				
1. Central American countries	2	12.3	Meet with cooperators; work in field; attend PCCMCA	2,880
2. Dominican Republic & Haiti	1	10	Meet with cooperators; work in field	700
3. Jamaica	2	5	Meet with cooperators; work in field	1,020
4. Trinidad and Guiana	1	6	Meet with cooperators: work in field	870
5. Colombia and Ecuador	2	6	Meet with cooperators; work in field; attend bean disease workshop at CIAT	1,520
				7,890
				2,660*
				$10,550

3. Other Direct Costs

Labor and miscellaneous supplies (fertilizers, pesticides, fuel for vehicles and other minor items) needed in-country by cooperators to handle advanced line and cultivars supplied by the project for regional testing $3,600

Total $27,650

* Cost of travel of Project Director to accompany outreach agronomist in the first trip to each country.

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE) — PAF

2. DOCUMENT CODE: 5

3. COUNTRY/ENTITY: DS/AGR RDA-2 Type A, Research

4. DOCUMENT REVISION NUMBER: 4

5. PROJECT NUMBER (7 digits): 931.0562.1

6. BUREAU/OFFICE: A. SYMBOL: DSB; B. CODE: 10

7. PROJECT TITLE (Maximum 40 characters): Improvement of Tropical Beans/Cowpeas

8. PROJECT APPROVAL DECISION — ACTION TAKEN: A = APPROVED, D = DISAPPROVED, DE = DEAUTHORIZED

9. EST. PERIOD OF IMPLEMENTATION: YRS. 00 QTRS. 3

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY ___ F. GRANT	E. 1ST FY ___ G. LOAN	H. 1st FY 79 I. GRANT	H. 1st FY 79 J. LOAN	K. 2nd FY 80 L. GRANT	K. 2nd FY 80 M. LOAN
(1) FN	111I	973		2,422		291		0	
(2)									
(3)									
(4)									
TOTALS				2,422		291		0	

A. APPROPRIATION	N. 3rd FY 81 O. GRANT	N. 3rd FY 81 P. LOAN	Q. 4th FY 82 R. GRANT	Q. 4th FY 82 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN	0		0		2,713	
(2)						
(3)						
(4)						
TOTALS	0		0		2,713	

11. PROJECT FUNDING AUTHORIZED — A. GRANT / B. LOAN

ENTER APPROPRIATE CODE(S): 1 = LIFE OF PROJECT, 2 = INCREMENTAL LIFE OF PROJECT — 2 / -

C. PROJECT FUNDING AUTHORIZED THRU — FY 80

12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000)

A. APPROPRIATION	B. ALLOTMENT REQUEST NO. ___ C. GRANT	B. ALLOTMENT REQUEST NO. ___ D. LOAN
(1)		
(2)		
(3)		
(4)		
TOTALS		

13. FUNDS RESERVED FOR ALLOTMENT

TYPED NAME (Chief, SER/FM/FSD)

SIGNATURE

DATE

14. SOURCE/ORIGIN OF GOODS AND SERVICES: ☐ 000 ☐ 941 ☐ LOCAL ☐ OTHER ___

15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

Ten month extension (Dec. 1, 1979 to Sept. 30, 1980) approved by RAC requiring additional funds of $291,339 for subject project. This amendment is required to provide for orderly completion and summarization of activities for project termination by Sept. 30, 1980.

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE (MM DD YY)	18. ACTION REFERENCE (Optional.)	ACTION REFERENCE DATE (MM DD YY)

AID 1330-5 (7-76)

PROJECT AUTHORIZATION AND
REQUEST FOR ALLOTMENT OF FUNDS

PART II

ENTITY : Bureau for Development Support

PROJECT : Improvement of Tropical Beans/Cowpeas

PROJECT NUMBER : 931-0562.11

I hereby authorize $291,339 in Grant Funds for a ten month extension (from Dec. 1, 1979 to Sept. 30, 1980) of the subject project with the University of Puerto Rico. The total approved funding level for this project is hereby increased from $2,422,000 to $2,713,339. The extension of the project will allow for orderly completion of summarization of activities for project termination by Sept. 30, 1980.

Tony Babb
Deputy Assistant Administrator
for Food and Nutrition
Bureau for Development Support

Date: 8/29/79

Attachments:
DS/AGR Memo to DAA/FN/DSB
Project Paper

Clearances:
DS/AGR/FCP:JMYohe Date: 7/2/79
DS/AGR/FCP:KMByergo Date: 7/31/79
DS/AGR:MMozynski Date: 8/1/79
DS/AGR:DFPeterson Date: 8/1/79
DS/PO/RES:MRechcigl Date: 8/30/79
DS/PO:RSimpson Date: 8/22

July 31, 1979

ACTION MEMORANDUM FOR THE DEPUTY ASSISTANT ADMINISTRATOR
FOR FOOD AND NUTRITION, BUREAU FOR DEVELOPMENT SUPPORT

FROM: DS/AGR, Dean F. Peterson

SUBJECT: Ten Month RAC approved, Extension Requiring $291,339 for the Research Project "Improved Tropical Production of Beans and Cowpeas (931-0562; Contract AID/ta-c-1296) with the University of Puerto Rico (UPR)."

Problem: Your authorization is required for a ten month extension requiring $291,339 for the subject research project.

Discussion: A.I.D. initiated this research project with the University of Puerto Rico in 1973 to investigate and develop methods for controlling diseases and insects of selected food legumes adapted to the tropics, namely, beans and cowpeas. A.I.D. has obligated and funded a total of $2,422,000 for this project.

This project was administratively extended on September 30, 1978 to allow presentation of the new project paper, for extension, to be considered by the October 31-November 1, 1978 RAC meeting. Due to aspects of the project that were unacceptable to RAC, they called for a revised proposal to be submitted to the January 31, 1979 RAC. Again this ran into some design difficulty with RAC because they felt the project extension should be designed for a two-year phase out plan as compared to the more active research implementation plan as presented. Therefore at the January 31, 1979 meeting, RAC tabled further consideration of the project until the July RAC meeting. The RAC requested the University of Puerto Rico to completely rewrite the project proposal for reconsideration at that time. UPR did a complete rewrite of the project proposal and this was reviewed at the July 13, 1979 meeting of RAC. RAC was pleased with the new presentation as it was responsive to RAC's concerns and presented a scope of work that was appropriate for bringing the project to termination by September 30, 1980. The proposed budget is a reduction from earlier levels of annual funding. It will allow the UPR staff to maintain the breeding activities, training, and outreach while reducing effort in the laboratory research on pathology and entomology. The present scope of work calls for the staff to summarize all data, to prepare scientific and required A.I.D. reports in preparation for project termination.

A bean/cowpea Collaborative Research Support Program (CRSP) is scheduled for implementation in FY 80. All A.I.D. funded activities with UPR on beans/cowpeas subsequent to Sept. 30, 1980, will fall under the purview of this upcoming bean/cowpea CRSP. DS/AGR is interested in Puerto Rico as a site for tropical bean and cowpea research for the upcoming Bean/Cowpea CRSP. Though there is no guarantee that UPR will be selected as a Bean/Cowpea CRSP participant, DS/AGR does feel that they will be a strong contender due to the fact that UPR is a land grant university,

thus eligible to participate in the Title XII program, and among land grant universities has the unique distinction of being located within the tropics. Should UPR not be one of the major participating universities in the CRSP program it would certainly be selected as a participating university due to its unique location and the experience in bean/cowpea breeding and research programs.

The work to be performed with the additional $291,339 ten month extension is specified in the "scope of work" of the approved project paper as revised under the guidance of the RAC.

This continuation is based on an earlier unsolicited research and development proposal. This extension meets the guidelines for contract amendments, under exceptions to normal negotiation procedures, 41 CFR 7-3.101-50(c)(2) where contract amendments which provide for the "continuation of activities" or assistance, which in the judgement of the contracting officer are designed to meet a goal which is the same as, or substantially similar to, the goal stated in the original contract.

Recommendation: That you approve the ten month extension requiring funds of $291,339 by signing the attached PAF.

Attachment: a/s

RAC Meeting - July 12-13, 1979

Food and Nutrition

Improvement of Tropical Production of Beans and Cowpeas Through Disease and Insect Control (Extension) - University of Puerto Rico. Duration of extension, 2 years; extimated additional cost, $929,736.

Project Summary and Background: The goal of this project is to improve production of cowpeas and soybeans in the tropics. The common bean and cowpea are the major grain legumes providing sources of protein in the human diet of LDCs located in the tropics. In all production regions, susceptibility of legumes to diseases is a major problem. The focus of this project is the breeding of disease resistant varieties of beans and cowpeas.

Based on project accomplishments which were noted "with commendation," a site visit review team recommended a two year extension in June 1978. The extension documents, however, were considered unacceptable when reviewed at the November 1978 and January 1979 meetings. The RAC members requested that more care be exercised in the design of field experiments, that a publication schedule be developed, and that a network of researchers be established in the Caribbean region to test the germplasm in the program. The revised proposal, responsive to previous RAC criticism, will focus on publication of results and extension of the breeding program. Chemical control aspects of the previous project will not be pursued.

RAC Recommendation: That the extension be approved with the understanding that:

1. The symposium be held with funds from other AID sources (as indicated by the AID staff);

2. AID and Puerto Rico agree on a list of publications required to meet contractual requirements; and

3. Puerto Rico work diligently to bring all biological materials to a stage of usefulness so that they can be made available to other research workers at the completion of the project extension on September 30, 1980.

Minutes of DSB Project Review Committee

September 6, 1978

Beans and Cowpeas AID/ta-C-1296

Dr. Yohe (DS/AGR) briefly explained the history of this project and why it moved to Puerto Rico in 1974 where the University has provided excellent technical backstop and access to an experimental farm system through out the island.

- He apologized for the document being late but circumstances prevented its earlier arrival.
- He indicated that Title XII has considered beans/cowpeas as a high priority area. A planning grant is being prepared in this area and Purerto Rico will work out future arrangements within the framework of Title XII after this two year extension request terminates.

Ms. Doyle (ASIA/TR) wondered if any Asian Countries were involved in this project?

Yohe - The primary focus has been LA but materials have been exchanged with scientists in Taiwan, Pakistan, and India.

Balis (LA) - This area is very important, however, was not pleased with the interface of this project with other LDC institutions in LA. More linkages must be formed.

- Was not overly enthusiastic with this project. He didn't see any real specific objectives for the next two years.

Yohe - Indicated that 1st recommendation of the recent site visit team was the need to improve the projects outreach network. This would be done in a number of ways including hiring a coordinator to take care of linkages between PR and other institutions.

Cal Martin (ASIA) felt project should terminate in two years.

- Would like more specifics on the outreach program.

Gates (AFR) felt this is an important area and should be done.

- Suggested some problem with outreach program.

Balis - Really don't see what generally has been done or accomplished to date. The progress to date is very specific and detailed.

Yohe - Explained outreach already, and plans being made to improve its effectiveness. He indicated that yearly workshops are being held and could be expanded in the last year.

Kevs MacManus (NE/TECH) felt that the paper did not clearly describe the procedure for the next two years.

Erickson (DS/PO/RES) - Was a member of recent view team. He indicated that outreach was a major problem area that the team focused on and made recommendations to improve. He also indicated that the two year work plan was extremely precise and, if it was considered too precise, it was in part due to the team's request that the Univesity provide the Agency with more details of progress to date and future research to be undertaken.

Babb (DS/DAA) - Wondered what timing was being considered for the CRISP?

Yohe - Inidcated Michigan would prepare a scope of work for a planning grant. Overall planning period would extend to around July 1979 with the actual program beginning some time after that.

Heilman (DS/PO) - Wondered about the evaluation plan and procedures to guarantee utilization. He requested that a more detailed evaluation plan be included.

Babb summed up discussion by indicating the need to sharpen up the objectives of the outreach program and the projects progress and goals. PPC did not comment.